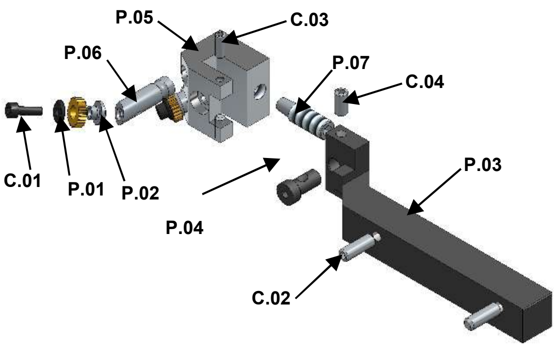


1 FEASIBLE PATTERNS

KNURLING PROFILE	KNURL AXLE L	AXLE R	FEED (Drawing.3) F
RGE 30°	AA	AA	✓
RGE 45°	BL15°	BR15°	✓

MF 89 cut knurling tool is conceived to perform knurling on workpieces with diameters between 1.5 and 12 mm.

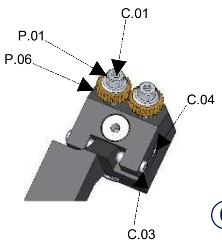
2 KNURL ASSEMBLY

Loosen alternately the screw that locks the axle of the C.01 knurls and pull them out together with the P.01 washers.

Put the knurls into their axles, bearing in mind where each one goes, it is advisable that the bore of the knurl be cleaned before and graphite grease be spread.

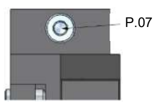
Place the washers P.01 above the knurls.

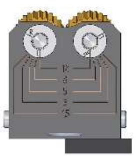
Tighten firmly the knurls and the washer by means of the screw C.01, making sure that the knurls run free.



3 SETTING THE KNURLS ACCORDING TO THE WORKPIECE´S DIAMETER

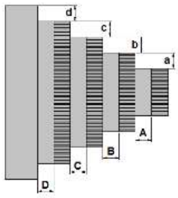
- Loosen P.07 screw that locks the P.06 orientation shafts.
- Right after, with the same allen wrench inserted in the back side of the P.06 orientations shafts, make them turn until the graduated scale E indicates the diameter of the corresponding piece to knurl.
- Take into account that the scale does not cover infinite values, so the position is not always exact. If the diameter of the workpiece does not appear in the scale, the shafts must be positioned on the closest value.
- Once scale is correct, tighten firmly with the P.07 locking screw.





4 KNURLING ON STEPPED WORKPIECES

It is not possible to knurl all the surface up to the shoulder on stepped workpieces. In order to avoid the tool colliding with the workpiece and/or mechanical parts on the machine, the following minimum distances have to be respected (depending on the diameter of the knurls):



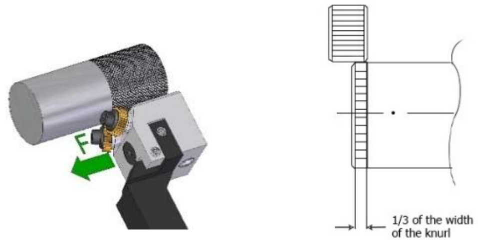
	Ø8.9
a	6
A	2.5
b	3
B	2.5
c	2
C	2
d	1
D	1.5

5 BEGINNING TO KNURL

With the chuck rotating according to the conditions recommended in table 1, move the tool until the knurling wheel is positioned in the corner of the workpiece with only 1/3 of the width of the knurling wheel on the workpiece and 2/3 in the air.

Once the knurl contacts the piece, plunge until the desired depth is got, by no means plunge in the beginning more than 45÷48 knurl`s pitch being used. When the knurling is being performed, we realize that there is an angular misalignment and that misalignment does not exceed 5°, we correct the position of the head.

We feed longitudinally following the parameters shown on the table 1.



Drawing.4

6 BEAR IN MIND BEFORE AND WHILE WORKING PROCESS

Make sure that the knurl pins are firmly fastened.

Make sure that the axis of the knurl is aligned with the axis of the workpiece.

Always work plenty of coolant, lubricant or cutting oil.

The working direction, longitudinal advance, will always be against the tool.

7 TROUBLE SHOOTING

PROBLEM	CAUSE	SOLUTION
Double knurling	Too slow radial feed at the beginning of the knurling	Increase radial feed at the beginning of the knurling*
	The perimeter of the workpiece is not an exact multiple of the pitch	Turn a diameter so that the perimeter to be knurled is an exact multiple of the pitch*
Knurling wheels easily breakable	Knurling too deep	Reduce the depth to values according to the pitch
Knurling wheels wear out too fast	Knurling too deep	Reduce the depth to values according to the pitch
	Working conditions are not adequate	Check cutting speed and traverse feeding speeds

* Sometimes, it is not possible to increase radial feed or it just cannot be radially fed in the workpiece is too weak.

8 RECOMMENDED SETTINGS

MATERIAL	Ø WORKPIECE (mm)	Ø KNURL (mm)	CUTTING SPEED (m/min)	RADIAL FEED (mm/rev)	TRAVERSE FEED PITCH (mm) 0.3÷0.6	0.6÷1.2	1.2÷1.6	1.6÷2.0
Steel 600 N/mm^2	<12	8.9	30÷50	0.05÷0.10	0.15	0.10	0.08	0.05
Steel 900 N/mm^2	<12		15÷30	0.04÷0.08	0.12	0.08	0.05	0.04
Stainless steel	<12		15÷30	0.04÷0.08	0.12	0.08	0.05	0.04
Cast steel	<12		30÷50	0.05÷0.10	0.15	0.10	0.08	0.05
Aluminium	<12		50÷70	0.05÷0.10	0.15	0.10	0.05	0.05
Brass	<12		35÷55	0.05÷0.10	0.15	0.10	0.12	0.05

Table 1